VMEbus Crate Utility Card

Bob Florian, Al Jones, and Mike Shea

1.0 Introduction

The Crate Utility Card is a multifunction VMEbus module designed to support the operation of VMEbus local control stations. This card contains the following features:

- Support for a local console including:
  --32 character by 16 line composite video display driver (6847)
  --One asynchronous serial I/O port (68901)
- Station Address switches (8-bits)
- Software Option switches (8-bits)
- Three 8-bit groups of LEDs
- Access to LED drive signals for software performance and. diagnostic timing studies
- Four 8-bit timers (68901)
- External interrupt support
- Interface to event timing system receiver/buffer/decoder
- 16-channel OPTO22 interface
- 2 bits of 12V high-side driver outputs (MC3399)
- 2 bits of isolated relay contact output (N.O. or N.C.)
- "Beeper" software triggered
- Software initiated reset
- Watchdog timer reset

2.0 General Description

This section contains a description of each of the features of the Crate Utility Module. A block diagram is shown in Figure 1.

2.1 Console Support

An external small console connects to the Crate Utility card using a front panel 9-pin "D" connector. This connector contains a serial transmit pair, a serial receive pair and a composite video output. A "Linac Style" console can be driven from this connector using the opto-isolator interface. An RS-232 driver/receiver can be jumper selected for other applications..

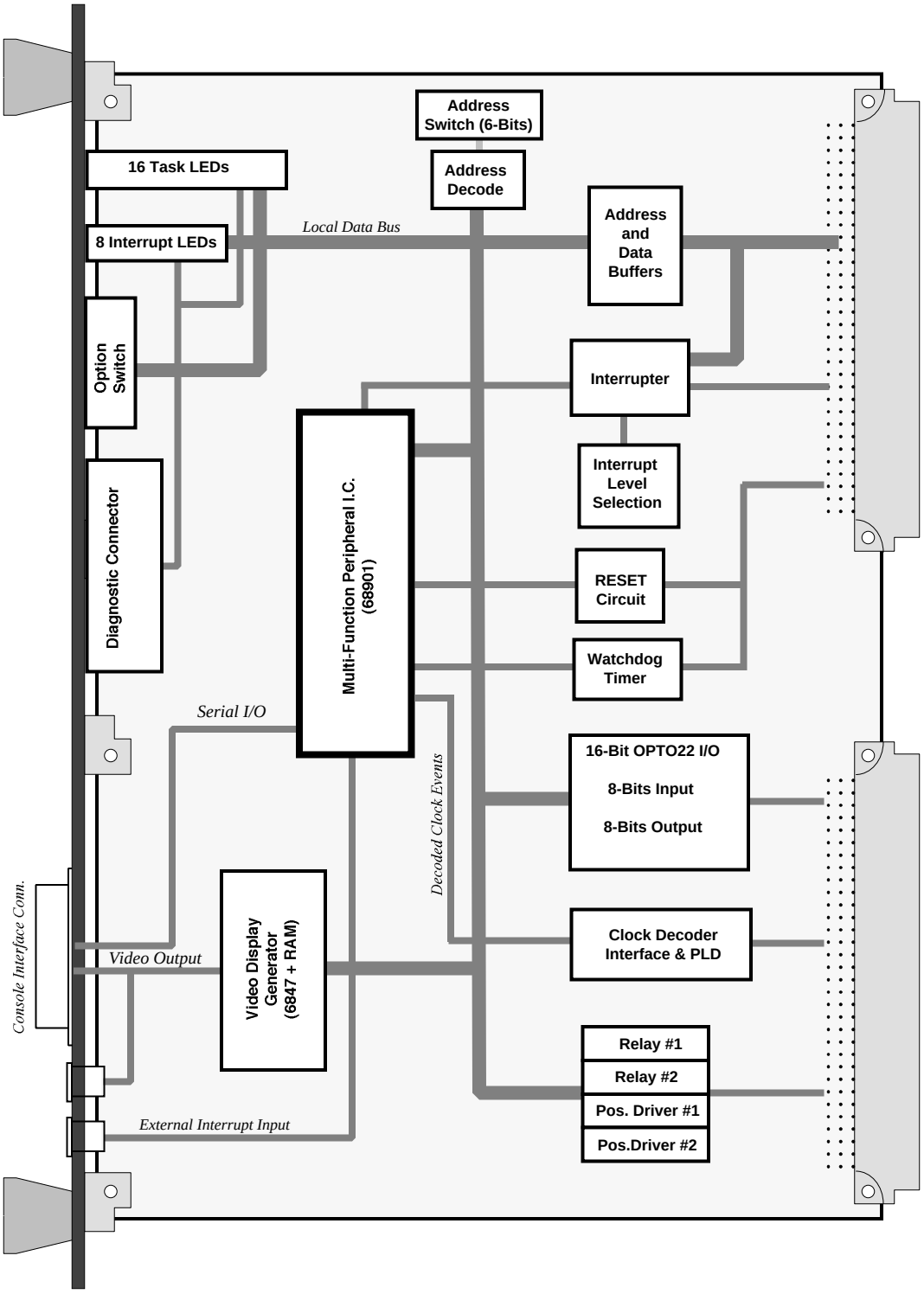

Figure 1. Crate Utility Card Block Diagram

2.2 Memory Map

The Crate Utility card uses 1K byte of memory in the VMEbus short I/O space. A six bit DIP switch selects the base address of the module. The memory map of the module is shown in Figure 2.

The first half of the 1K byte memory block is used to address the video display RAM. Contents of this memory are continuously scanned and processed into a black and white composite video signal by the 6847 video display generator.

Address Offset	Access	Function
00-1FF	R/W	512 Byte Video RAM
200-2FF	R/W	68901 Multifunction Peripheral (Odd Addr. Only)
300	R	Option Switches
301	R	Station Number Switch
302, 303	R/W	"Task" LEDs
304	R/W	"Interrupt" LEDs
306	R/W	OPTO22 Output Byte
307	R	OPTO22 Input Byte
308	R/W	Positive Drivers and Relays
309	W	Beeper *(Write with D0 = 1)*

Figure 2. Memory Map for the Crate Utility Card

2.3 Multifunction Peripheral Chip

The 68901 chip supports several of the miscellaneous functions needed in a real time local control station. Four 8-bit onboard timers are available for use by the system and the asynchronous serial port is used to communicate with the local console's keyboard, knob, switches and lights. The chip includes a flexible 8-bit digital I/O port that allows each bit to be programmed as an input or an output bit. Input bits can be enabled to cause interrupts. The 68901 asserts its interrupt on a single VMEbus IRQ level, but there are sixteen separate vectors that are returned depending upon the interrupt source. All 68901 I/O bits are brought to jumper pins on the card. When jumpers are installed these I/O bits are connected as listed in Figure 3.

The most significant bit I7, TV Ready, is a bit that the 68020 can monitor to perform video RAM updates during the horizontal retrace time to avoid flicker on the screen. The 15Hz interrupt is normally input through a front panel Lemo connector to I5. Writing a 1 to output bit I3 will cause the VMEbus RESET line to be asserted.

Output bit IO triggers a retriggerable one shot that has a timeout of ~ 200 ms. Once this one shot has been activated, it must be retriggered periodically, say 15 times per second, to keep it active. If a timeout occurs, the VMEbus RESET line will be asserted.

Bit Number	Function
Bit 7	TV Ready
Bit 6	Unassigned (Event Interrupt)
Bit 5	Front Panel Interrupt Input
Bit 4	Unassigned (Event Interrupt)
Bit 3	Reset Output
Bit 2	Unassigned (Event Interrupt)
Bit 1	Unassigned (Event Interrupt)
Bit 0	Watchdog Timer Trigger

Figure 3. Multifunction Peripheral I/OBit Assignments
(Address = Base+201)

Unassigned bits I6, I4, I2 and I1 are intended to connect to a PLD that selects clock event triggers, decoded by the clock interface board, to be used as interrupt to the processor.

2.4 Digital Input/Output

The Crate Utility card interfaces to a 16-channel OPT022 mounting rack using a 50 pin ribbon cable from pins 1-25 of Rows A and C of the P2 connector. One byte of output and one byte of input are available at addresses Base+306 and Base+307, respectively. A fused +5V pin is included in the interface to power the LEDs on the OPT022 rack.

In addition to the OPT022 interface, two high current drivers and two relays are available on P2. The drivers are Motorola MC3399 automotive high-side drivers capable of sourcing a few hundred mils of current from the +12 Volt supply.

Isolated contacts from two Form C relays are brought on P2. Jumpers on the card allow either the N.O. or N.C. contacts to be selected. Both the high-side drivers and the relays are accessed at Base+308 as given in Figure 4. Pin assignments on P2 for all digital I/O signals are shown in Figure 5.

2.5 Clock Interface Connector

Pins are assigned on P2 to allow a differential event encoded clock to be received on one cable and buffered out again on two separate cables. These traces terminate at a connector intended for mounting a small clock decoder daughter board. This was done in order to accommodate either Tevatron clock decoders or AMD TAXI serial data receiver chips. The connector pinout, shown in Figure 6, routes 8 bits of data, 4 command bits and both data and command strobes to a PLD socket. The PLD can then

be programmed to select the appropriate event values, gated by the command/data strobes, and output the resulting pulses to 68901 input pins.

2.6 Front Panel

The front panel of the Crate Utility card shows the three bytes of LED interrupt and task lights (Figure 7) and gives access to the LED electrical signals on J1 (Figure 8) for diagnostic purposes. In addition, the console interface connector J7 (Figure 9), a console video out CON2, an input interrupt connector CON1(50Ω input impedance) and an 8 bit "Option" switch are all accessible on the front panel.

Bit Number	Function
Bit 7	Positive Driver #2
Bit 6	Positive Driver #1
Bit 5	Relay #2
Bit 4	Relay #1
Bit 3-0	Not Used

Figure 4. Bit Assignments for Misc. Output Byte
(Address = Base+308)

Pin Number	Row A	Row C	
1	Gnd	N.C.	
2	Gnd	N.C.	
3	Gnd	N.C.	
4	Gnd	N.C.	
5	Gnd	N.C.	
6	Gnd	N.C.	
7	Gnd	N.C.	
8	Gnd	N.C.	
9	Gnd	Digital OUT 7	
10	Gnd	Digital OUT 6	
11	Gnd	Digital OUT 5	
12	Gnd	Digital OUT 4	
13	Gnd	Digital OUT 3	*Designed to match OPTO22 Pinout*
14	Gnd	Digital OUT 2	
15	Gnd	Digital OUT 1	
16	Gnd	Digital OUT 0	
17	Gnd	Digital IN 7	
18	Gnd	Digital IN 6	
19	Gnd	Digital IN 5	
20	Gnd	Digital IN 4	
21	Gnd	Digital IN 3	
22	Gnd	Digital IN 2	
23	Gnd	Digital IN 1	
24	Gnd	Digital IN 0	
25	Gnd	+5 Volts	
26	Clock IN +	Clock IN -	
27	Clock OUT 1 +	Clock OUT 1 -	
28	Clock OUT 2 +	Clock OUT 2 -	
29	Pos.Driver Rtn	Pos. Driver Out (D15)	
30	Pos.Driver Rtn	Pos. Driver Out (D14)	
31	Relay 2	Relay 2 Rtn	
32	Relay 1	Relay 1 Rtn	

Figure 5. P2 Connector Pinout

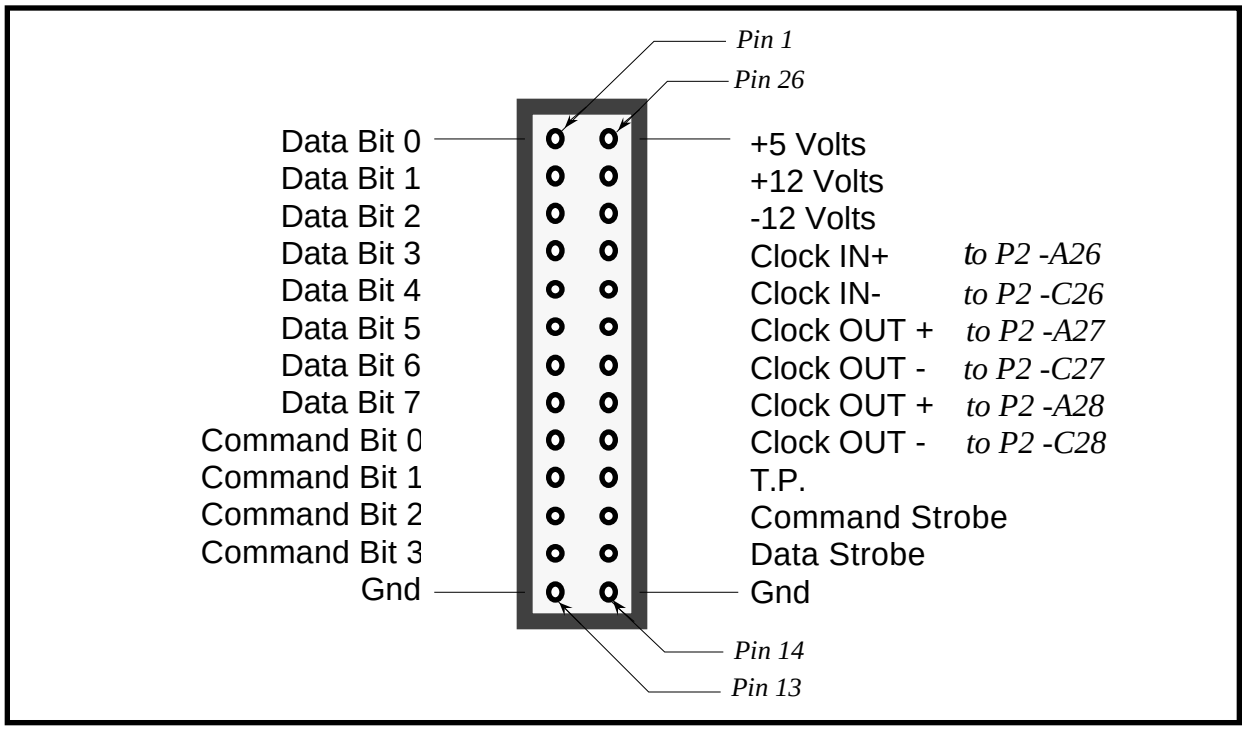

Figure 6. Clock Interface Connector

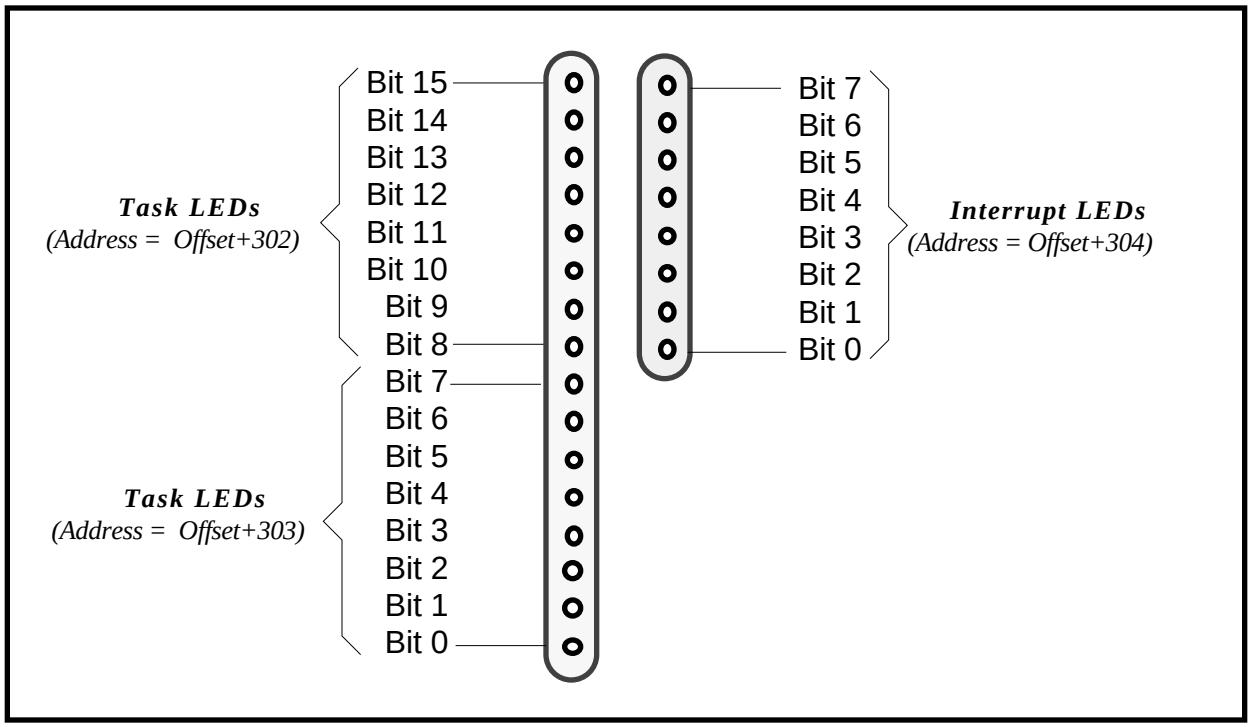

Figure 7. Task and Interrupt LED Locations

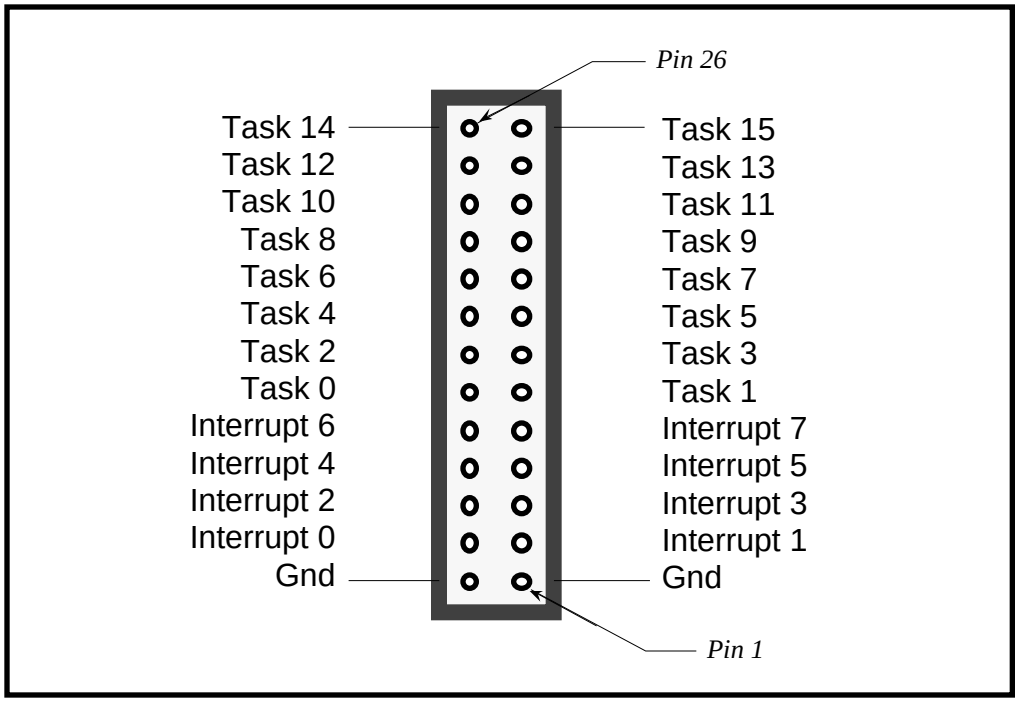

Figure 8. Test-Point Connector Pinout

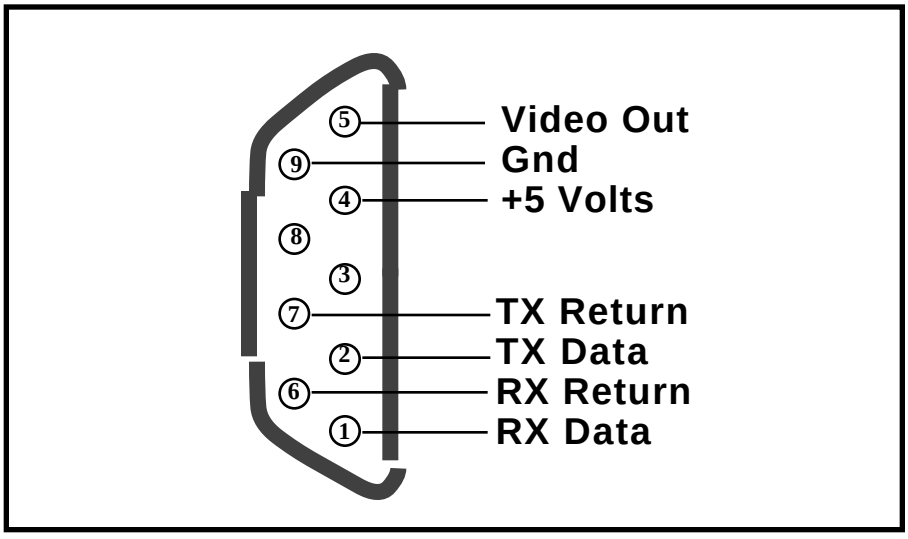

Figure 9. Console Connector Pinout

3.0 Jumper Options

Several options on the board are selected by jumpers Their functions and placement on the board are detailed in Figures 9 and 10. J1 sets the interrupt level that will be asserted on VMEbus for all the 68901 interrupts, the only interrupting device on the board. When pins 4 and 5 of J1 are jumpered together,the Watchdog Timer is disabled.

J4 and J7 must both be configured as shown in Figure 10 to use the serial I/O opto-isolator interface. The alternate arrangement connects the RS-232 interface.

J5 is simply a row of 2-pin jumper locations to connect individual digital I/O bits of the 68901 general purpose I/O register. For some other application these bits may be assigned differently. In the interrupt structure of the 68901, the internal interrupts are prioritized. The priority order of these bits is given in the 68901 data book.

J8 and J9 allow the user to select the N.O. or the N.C. contacts of the two isolated relay outputs.

J10 is the connector for the clock decoder daughterboard described in section 2.5.

Jumper #	Funtion
J1	IRQ Selection
J2	N.C.
J3	Serial Baud Rate Select
J4	Serial I/O Opto/RS-232 Select
J5	68901 Digital I/O Select
J6	OPTO22 Output Polarity Select
J7	Serial I/O Opto/RS-232 Select
J8	N.O./N.C. Select, Relay U37
J9	N.O./N.C. Select, Relay U36
J10	Clock Interface Connector

Figure 9. List of Crate Utility Jumper Location

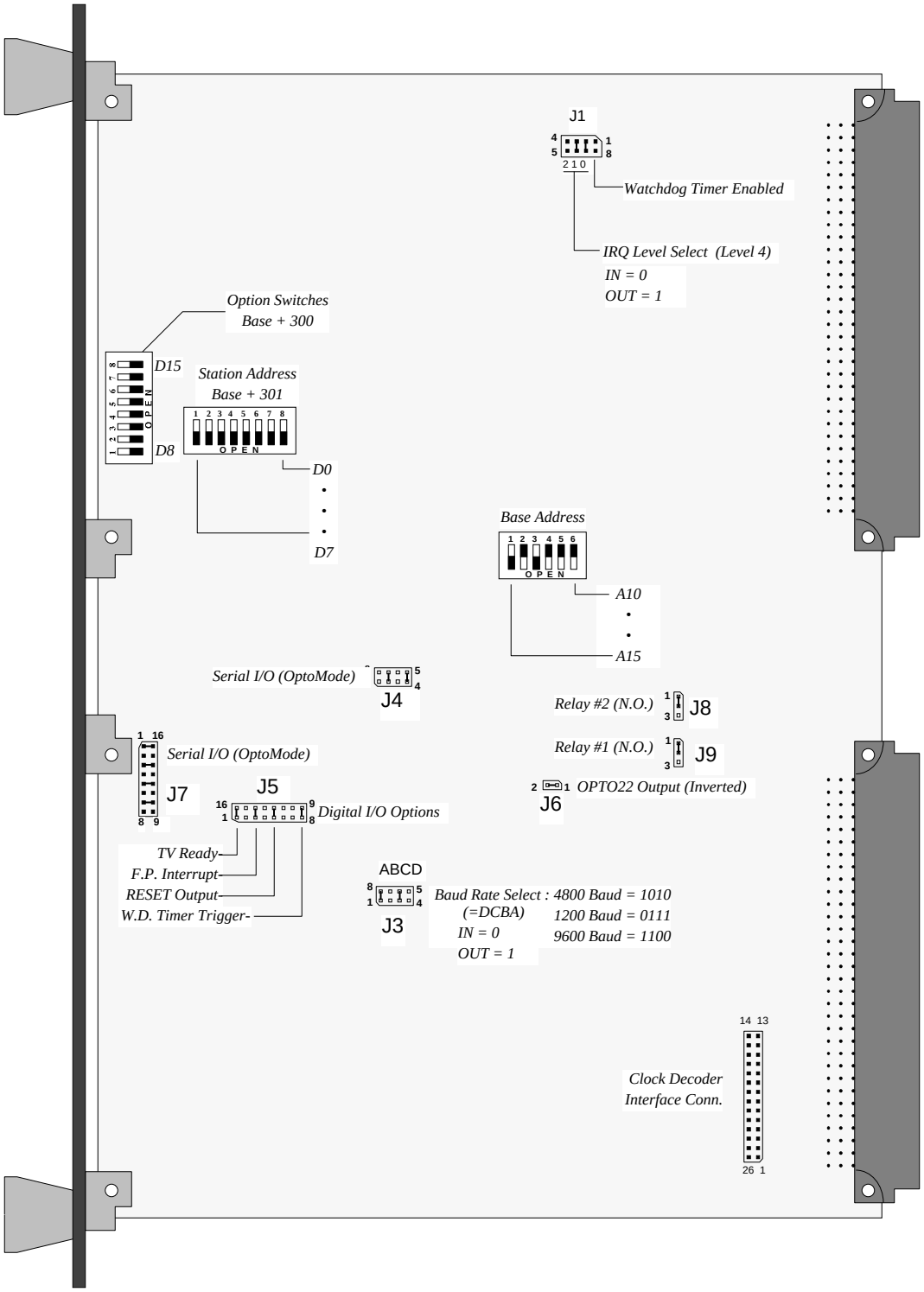

Figure 10. Location of Crate Utility Jumpers